



ENVIRONMENTAL DATA BASE FOR REGIONAL STUDIES IN THE HUMID TROPICS

US ARMY
TROPIC TEST CENTER
Fort Clayton, Canal Zone

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**ENVIRONMENTAL DATA BASE
FOR REGIONAL STUDIES IN THE HUMID TROPICS**

**MONTHLY
MICROCLIMATIC SUMMARY**

AUGUST 1967

Prepared by

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MONTHLY MICROCLIMATIC SUMMARY

Introduction

Monthly microclimatic data summarized in this series of reports were collected by the US Army Tropics Test Center and the Weather Engineers of Panama Corporation under the project, Environmental Data Base for Regional Studies in the Humid Tropics. The project is sponsored by the Advanced Research Projects Agency of the Department of Defense and by the Army Research Office, Office of the Chief of Research and Development. It is an investigation of microclimatic, air chemistry, vegetation, soils, microbiological, and macrofaunal conditions at selected sites in the principal tropical environments of the Panama Canal Zone and the Rio Hato Military Reservation. The objective of the project is to assemble quantitative environmental data for RDT&E purposes.

Sites. Data summarized in this report were collected at the Albrook Forest and Chiva Chiva sites. Figure 1 shows the site locations within the Isthmus of Panama. Geographic coordinates are shown below:

Albrook Forest	09° 01'N,	79° 33'W
Chiva Chiva	09° 01'N,	79° 35'W

The Chiva Chiva open site and the Albrook Forest site are paired for comparative study of environmental conditions in a tropical semideciduous forest and in a large clearing. Both are located in a region where the annual precipitation is approximately 80 inches and there is a pronounced dry season. The other satellite sites were located primarily for soil studies purposes. Albrook and Fort Kobbe have climatic regimes similar to the principal sites.

The Albrook and Chiva Chiva main sites are approximately four kilometers apart. Each has a 46 meter walk-up tower and an air-conditioned building to house the recording equipment and observers. Both sites are approximately 30 meters above sea level. The top of the forest canopy at the Albrook site is about 26.5 meters above the ground.

Instrumentation. A wide range of climatic elements are measured at the Albrook and Chiva Chiva sites. Types of observations and frequencies are shown on Figure 2. The towers at the Albrook and Chiva Chiva sites are similarly oriented. Sensing equipment is mounted at several levels on the towers to provide measurements through the vertical profile. Additional instruments are emplaced in the immediate vicinity on or near the ground. All instrument exposures are duplicated at each site. Figures 3, 4, and 5 show the instrument array at these sites.

Data Reduction and Storage. All data, as applicable, are recorded at or reduced to each full hour and transposed to punch cards. These punch cards, together with all raw data, are stored in the Tropic Test Center Technical Library Annex.

The relative humidity data contained in this report required some adjustment due to the difficult problems in maintaining hair hygrometers in the humid tropics. The hygrometers show saturation at a time when the psychrometer shows a relative humidity well below 100%. For this reason the hourly measurements made by means of a hair hygrometer have been modified on the basis of simultaneous psychrometer readings of other levels. Details will be given in the fourth Semiannual Report. It can be assumed that the means of relative humidity presented in this volume are very close to the true means.

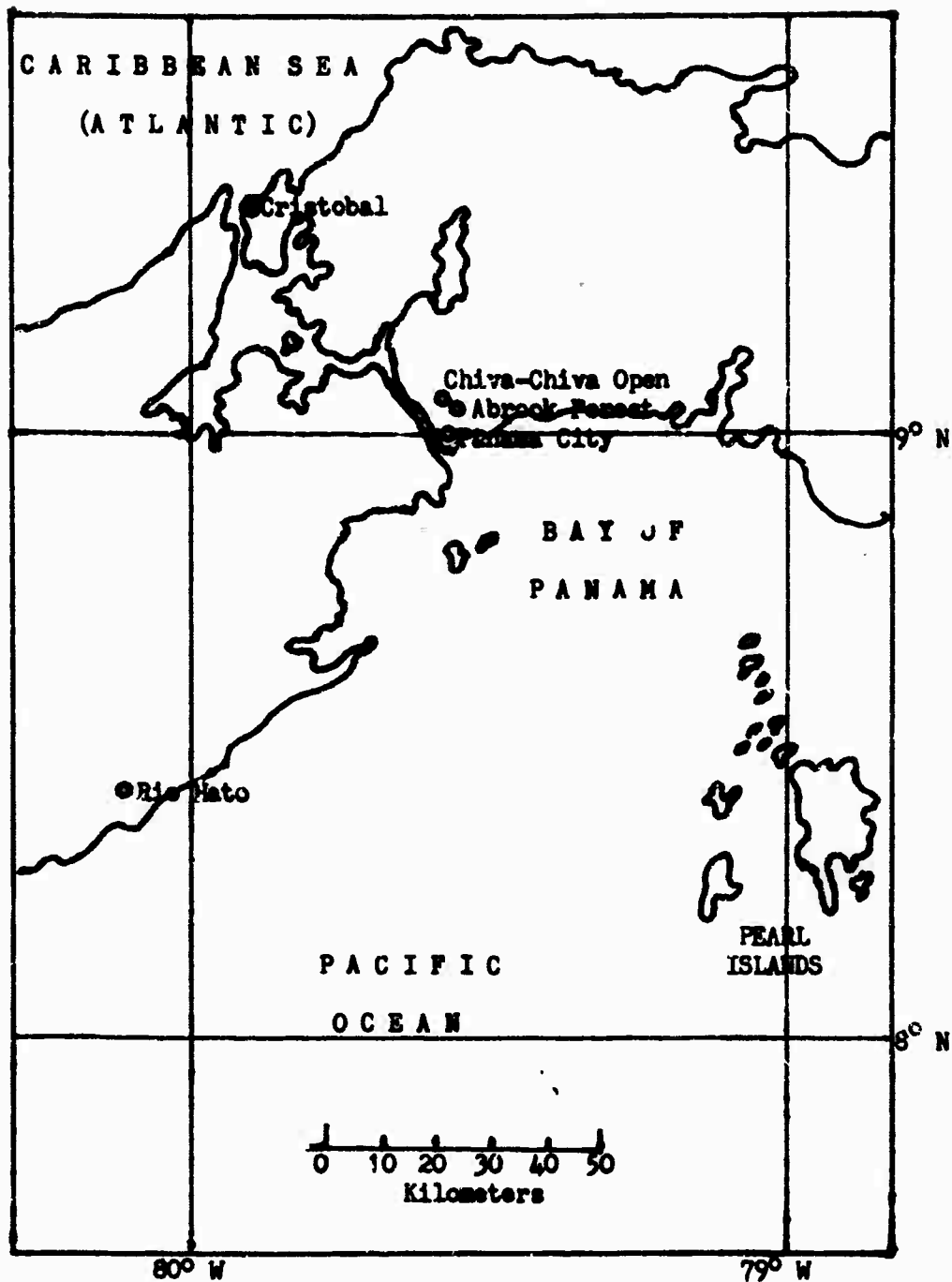


FIGURE 1.
LOCATION MAP, ISTHMUS OF PANAMA

FIGURE 2. FREQUENCY OF OBSERVATIONS

# Element	Height (meters)											Frequency
	Sfc	0.5	1.0	2.0	4.0	8.0	13.5	26.5	28.5	46.0		
Temperature:												
Dry Bulb	-	1	1	1	1	2	1	1	-	1	Hourly*/Continuously	
Wet Bulb	-	1	-	1	1	-	-	-	-	-	Hourly*/Continuously	
Grass Minimum	3	-	-	-	-	-	-	-	-	-	Once Daily	
WBGT Index	-	-	1	-	-	-	-	-	-	-	Hourly (0600-1900 EST)	
Relative Humidity	-	1	1	1	1	-	1	1	-	1	Hourly*/Continuously	
Barometric Pressure	-	-	1	-	-	-	-	-	-	-	Continuously	
Evaporation	-	1	-	-	-	-	2	2	-	2	Once Daily	
Precipitation:												
Recording Gage	-	-	1	-	-	-	-	-	-	2	Continuously	
Manual Gage	-	-	2	-	-	-	-	-	-	-	4 Times Daily	
Stem Flow	-	-	-	2	-	-	-	-	-	-	4 Times Daily	
Wind:												
Direction	-	-	-	-	1	-	-	1	-	2	Continuously	
Speed	-	-	-	3**	1	-	3**	1**	-	2	Hourly**/Continuously	

1. Allbrook and Chiva Chiva
 2. Allbrook only
 3. Chiva Chiva only

* Observations made with sling psychrometer when recorders are inoperative.

** Hourly

Instrument descriptions are contained in the Environmental Data Base semiannual reports.

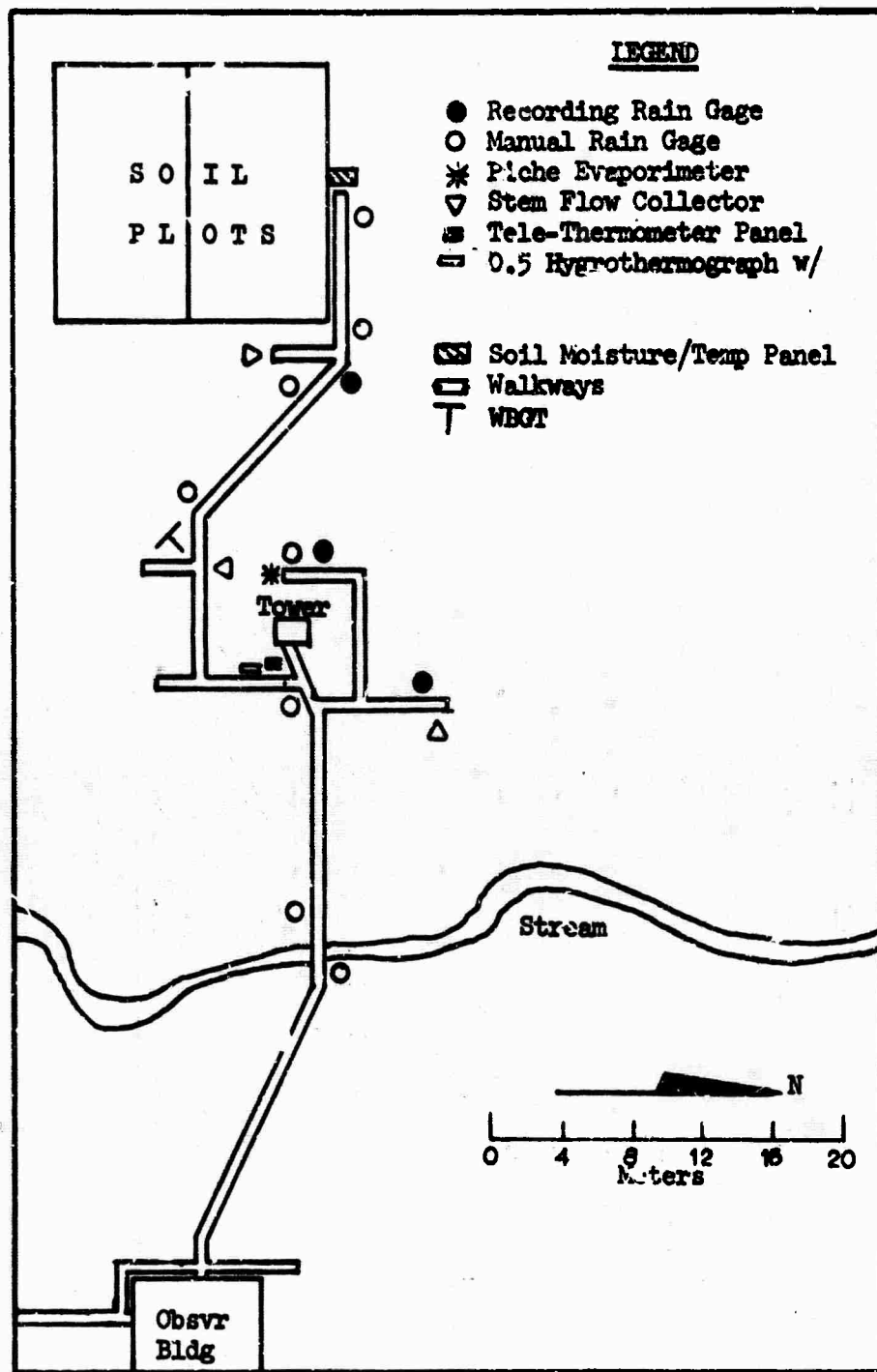


FIGURE 3.

ALBROOK FOREST SITE, GENERALIZED PLOT

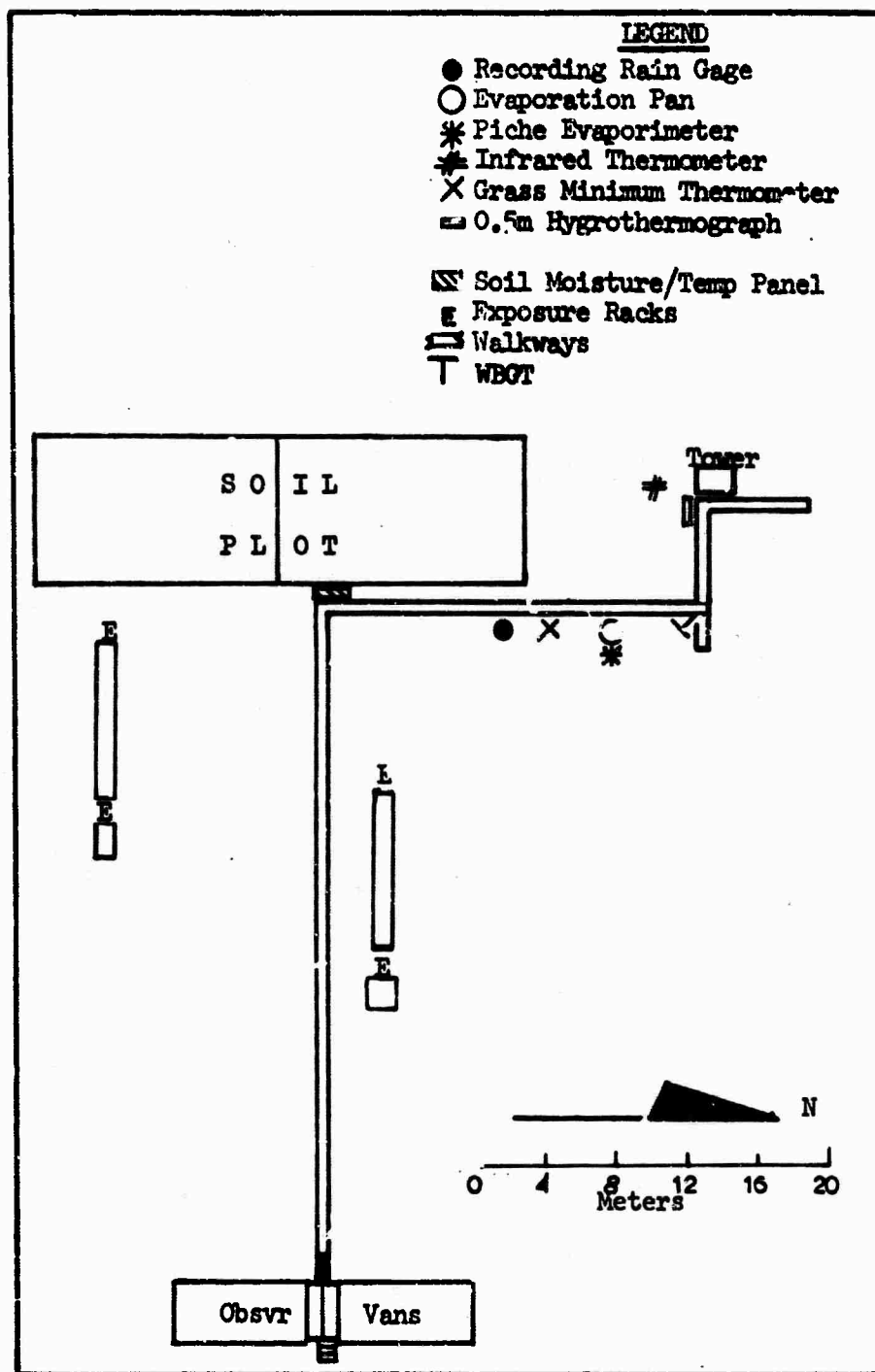


FIGURE 4.

CHIVA CHIVA OPEN, GENERALIZED PLOT

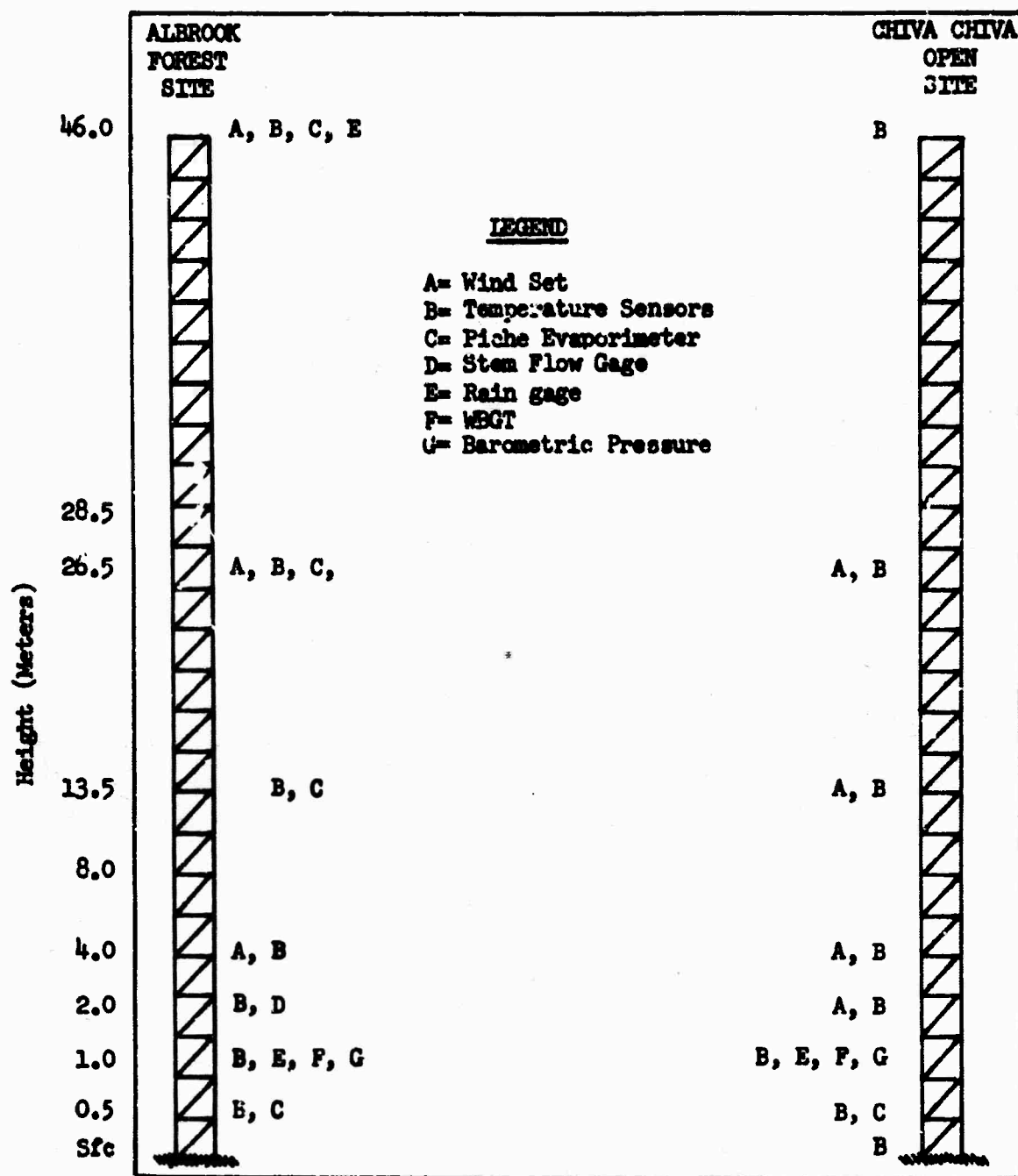


FIGURE 5. INSTRUMENT LOCATION ON TOWERS

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

AUGUST 1967

AUGUST 1967

Monthly Means of Air Temperature by Hour
(°F)

Exposure	Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Monthly Summary			
			No. of Obs.																											
Albrook (Forest site)	46.0 m		75.5	75.4	75.2	75.0	74.9	74.8	75.4	77.1	79.5	81.4	82.6	82.7	82.5	81.4	81.2	80.3	79.1	77.9	76.7	76.4	76.2	75.1	75.8	75.7	740	71.2	77.9	88.2
	28.5 m		This level was not instrumented for air temperature at this time																											
	26.5 m		75.4	75.2	75.1	74.9	74.8	74.7	75.3	77.2	79.7	81.7	83.4	83.4	83.3	82.5	82.0	80.8	79.8	78.5	76.8	76.3	76.0	75.9	75.7	75.5	744	71.4	78.1	89.0
	13.5 m		75.2	74.9	74.8	74.6	74.5	74.4	74.7	76.3	78.3	80.1	81.7	82.2	82.1	81.4	81.0	80.3	79.3	78.1	77.0	76.4	76.0	75.7	75.3	75.2	666	71.0	77.5	87.5
	8.0 m		This level was not instrumented for air temperature at this time																											
	4.0 m		74.7	74.6	74.5	74.3	74.2	74.2	75.0	76.9	78.7	80.1	81.6	81.3	81.4	80.5	79.9	79.3	78.7	77.4	76.4	76.0	75.7	75.5	74.9	74.9	735	70.0	77.1	87.2
	2.0 m		74.7	74.6	74.5	74.2	74.2	74.2	75.0	76.7	78.4	79.7	81.1	81.1	81.3	80.3	79.8	79.1	78.7	77.4	76.4	76.1	75.7	75.5	74.9	74.8	736	70.0	77.0	86.5
	1.0 m		74.8	74.7	74.5	74.3	74.2	74.2	75.0	76.6	78.3	79.6	80.9	80.8	81.1	80.3	79.6	79.0	78.7	77.5	76.6	76.2	75.8	75.6	74.9	74.9	736	70.0	77.0	86.7
	0.5 m		75.1	75.0	74.9	74.7	74.5	74.4	74.9	76.4	78.0	79.3	80.7	80.9	81.0	80.4	79.5	79.2	78.8	77.6	76.7	76.3	76.1	75.8	75.2	75.1	722	71.3	77.1	86.1

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Chiva Chiva (Open site)		46.0 m	76.0	75.8	75.7	75.5	75.4	75.5	75.5	76.5	78.5	80.4	81.8	82.2	81.9	81.0	80.4	79.8	78.8	78.2	77.5	77.0	76.6	76.6	76.4	76.1	744	70.6	77.9	88.8											
		28.5 m								This level was not instrumented for air temperature at this time																															
		26.5 m	75.7	75.6	75.3	75.2	75.1	75.1	75.3	76.7	78.7	80.4	81.9	82.4	82.2	81.1	80.6	79.9	78.9	78.2	77.3	76.8	76.5	76.3	76.2	75.7	744	70.5	77.8	87.7											
		13.5 m	75.5	75.5	75.2	75.0	74.9	74.9	75.4	77.0	79.0	80.9	82.2	82.6	82.5	81.5	80.8	80.2	79.2	78.4	77.4	76.8	76.5	76.3	75.9	75.5	744	70.5	77.9	88.8											
		8.0 m								This level was not instrumented for air temperature at this time																															
		4.0 m	74.8	74.5	74.3	74.0	74.0	74.1	75.7	78.6	80.7	82.7	84.0	84.1	84.2	82.7	81.8	80.9	79.5	78.5	77.1	76.5	76.1	75.8	75.1	74.7	743	69.5	78.1	89.7											
		2.0 m	74.7	74.5	74.2	74.0	73.9	73.9	75.7	78.8	81.2	83.4	84.8	84.8	84.8	83.2	82.3	81.5	80.0	78.6	77.2	76.5	75.9	75.7	75.0	74.6	742	69.0	78.3	91.4											
		1.0 m	74.5	74.3	74.0	73.7	73.7	73.7	75.8	79.0	81.6	84.1	85.3	85.3	84.8	83.3	82.2	81.2	79.6	78.1	76.7	76.0	75.4	75.2	74.8	74.5	741	68.3	78.1	93.7											
		0.5 m	74.4	74.2	74.0	73.7	73.6	73.5	75.7	79.2	82.0	84.2	85.9	85.5	84.9	83.6	82.2	81.4	79.7	78.2	76.7	76.0	75.4	75.2	74.8	74.4	734	68.5	77.2	93.3											

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

AUGUST 1967

Exposure		Monthly Ranges of Air Temperature by Hour (°F)																								Monthly Summary*		
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24			
Albrook (Forest site)	46.0 m	6.1	6.1	5.6	5.7	6.1	5.7	5.6	8.0	10.2	11.4	10.9	13.0	13.9	14.5	15.7	14.8	13.9	12.1	8.0	6.9	6.7	6.3	6.1	6.0			
	28.5 m								This level was not instrumented for air temperature at this time																			
	26.5 m	5.1	5.0	4.8	5.0	5.6	5.9	5.5	7.5	10.4	11.9	11.5	15.0	15.2	15.5	15.7	15.1	14.9	11.6	8.9	7.1	5.8	5.5	5.3	5.2			
	13.5 m	8.0	8.3	7.2	7.2	8.0	8.0	8.1	11.1	11.0	10.8	12.1	14.0	14.3	16.0	14.2	14.0	14.0	12.9	10.0	7.1	6.7	6.3	5.8	5.3			
	8.0 m								This level was not instrumented for air temperature at this time																			
	4.0 m	4.3	6.0	5.6	6.5	6.6	6.8	7.3	8.8	9.8	9.9	11.3	14.2	14.4	12.3	12.0	11.5	11.0	11.8	9.5	9.0	6.9	5.3	5.2	5.0			
	2.0 m	4.4	6.2	5.5	6.5	6.6	7.0	7.2	8.6	9.5	9.5	11.0	13.5	13.2	12.5	12.0	10.5	10.3	11.4	9.5	8.8	6.3	5.5	5.2	4.9			
	1.0 m	4.2	6.4	5.4	6.2	6.2	7.0	7.2	8.3	9.8	9.3	11.0	13.7	12.8	12.3	12.1	10.5	9.4	11.0	10.0	8.3	6.7	6.4	5.1	5.1			
	0.5 m	4.0	6.2	5.1	6.1	5.8	5.9	6.8	7.8	9.5	8.2	10.2	12.5	11.3	12.7	11.9	10.8	10.5	9.9	8.4	8.1	6.4	6.3	4.9	5.1			

* No monthly summary was computed for the ranges.

46.0m	6.3	5.5	4.3	5.1	5.0	5.5	6.0	7.6	9.6	12.7	10.1	15.9	15.0	16.6	14.8	13.7	16.9	13.0	10.5	8.9	5.5	6.0	6.3	6.7
28.5m	This level was not instrumented for air temperature at this time																							
26.5m	6.5	5.5	4.6	5.3	5.1	5.5	5.9	7.8	9.2	11.8	10.2	15.3	14.5	15.4	14.0	12.2	17.0	12.9	11.1	8.5	6.0	6.0	6.6	7.2
13.5m	6.7	5.3	4.4	5.4	5.3	5.9	5.6	8.4	9.9	12.3	10.8	17.0	14.5	16.5	14.1	13.5	17.5	13.4	10.6	9.2	7.5	5.9	6.7	7.3
8.0m	This level was not instrumented for air temperature at this time																							
4.0m	6.9	5.2	4.9	5.3	5.9	6.1	5.4	10.8	12.8	12.9	12.0	17.9	15.2	16.0	14.6	16.0	17.7	14.5	10.5	9.2	8.4	7.8	6.7	6.8
2.0m	6.3	5.8	5.3	5.8	5.8	5.8	5.9	10.9	12.9	14.0	12.5	19.2	17.0	18.8	15.9	16.5	19.1	15.9	11.0	9.6	8.7	7.2	7.3	6.8
1.0m	6.5	5.5	5.8	6.3	6.4	6.1	4.9	11.2	13.5	12.1	14.2	21.7	19.9	19.6	16.0	17.5	18.9	15.3	9.3	8.9	7.8	7.0	6.8	6.7
0.5m	6.3	5.6	5.3	6.2	5.5	5.9	5.0	11.9	13.8	12.9	15.6	21.3	19.5	20.2	15.5	17.6	18.7	14.7	9.3	8.9	7.8	6.8	6.8	6.8

SUMMARY OF METEOROLOGICAL OBSERVATIONS
 HOURLY DATA
 AUGUST 1967

Exposure		Monthly Means of Relative Humidity by Hour (%)																								Monthly Summary							
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Min.	Mean	Max.				
Albrook (Forest site)	46.0 m	94	94	94	94	94	94	93	90	84	77	75	77	79	80	82	84	87	90	91	92	92	93	94	734	63	67	97					
	28.5 m										This level was not instrumented for relative humidity at this time																						
	26.5 m	95	95	95	95	95	95	95	91	85	80	76	78	79	80	83	85	80	93	94	94	94	95	95	738	64	89	98					
	13.5 m	96	96	96	96	96	97	96	95	90	86	82	80	81	83	84	87	88	90	92	93	95	95	96	96	665	63	91	98				
	8.0 m											This level was not instrumented for relative humidity at this time																					
	4.0 m	97	97	96	97	97	97	96	95	91	89	84	85	85	86	88	90	90	92	93	94	95	95	97	96	734	66	93	100				
	2.0 m	97	97	97	97	97	97	97	96	93	90	87	86	86	88	89	92	91	93	94	94	95	96	97	97	735	69	93	100				
	1.0 m	97	97	97	97	97	97	97	96	94	92	88	89	87	89	92	93	92	93	94	94	95	95	97	97	711	68	94	100				
	0.5 m	97	96	97	96	97	97	96	96	94	93	90	90	90	90	92	93	93	94	95	95	95	97	97	721	75	94	100					

Chiva Chiva (Open site)	46.0 m	93	94	94	94	94	94	91	87	82	78	77	78	80	82	83	86	87	89	90	92	92	92	93	743	60	88	99					
	28.5 m							This level was not instrumented for relative humidity at this time																									
	26.5 m	94	94	95	95	95	95	94	92	86	82	78	77	80	82	84	85	87	89	91	92	93	92	94	744	60	88	99					
	13.5 m	94	94	95	95	95	95	94	91	86	82	78	76	77	80	81	83	85	87	90	91	92	93	94	744	60	88	100					
	8.0 m							This level was not instrumented for relative humidity at this time																									
	4.0 m	96	96	97	97	96	94	88	84	79	76	75	75	78	81	83	86	88	92	93	94	94	95	95	743	60	89	100					
	2.0 m	96	96	96	96	96	94	88	83	78	75	75	74	78	80	82	85	88	92	93	94	94	95	96	742	60	88	100					
	1.0 m	96	96	97	97	97	95	88	82	77	74	75	76	79	81	83	85	89	93	94	95	95	96	96	734	63	89	100					
	0.5 m	97	97	97	98	97	95	89	84	79	76	76	77	81	82	82	86	89	92	94	95	95	96	96	732	60	90	100					

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

AUGUST 1967

Exposure		Monthly Ranges of Relative Humidity by Hour																								Monthly Summary*	
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Albrook (Forest site)	46.0 m	9	9	7	7	7	7	9	14	26	31	30	32	33	31	30	28	29	23	18	15	13	12	8	9		
	28.5 m								This level was not instrumented for relative humidity at this time																		
	26.5 m	5	6	5	7	6	6	6	15	25	30	29	31	26	29	31	28	29	26	16	13	9	6	6	6		
	13.5 m	5	5	6	5	4	4	4	5	19	23	30	33	32	32	31	28	26	25	18	15	10	9	8	7		
	8.0 m								This level was not instrumented for relative humidity at this time																		
	4.0 m	7	14	14	13	14	10	15	15	19	22	29	30	30	32	33	21	19	20	18	17	17	16	10	9		
	2.0 m	8	14	14	13	14	11	15	15	17	20	28	29	25	26	26	18	18	18	16	16	16	16	10	8		
	1.0 m	8	14	14	13	13	10	15	14	16	18	30	24	25	32	20	15	17	17	15	16	15	17	8	8		
	0.5 m	6	15	14	13	13	10	12	14	15	15	23	22	18	19	21	16	18	18	15	16	16	14	6	8		

* No monthly summary was computed for the ranges.

Chiya Chiva (Open site)	46.0 m	13	13	15	15	11	13	16	21	23	27	30	34	29	30	35	33	35	29	24	20	13	14	13	14		
	28.5 m								This level was not instrumented for relative humidity at this time																		
	26.5 m	13	13	13	15	10	12	11	13	17	27	28	35	31	34	31	29	31	26	21	17	15	15	14	15		
	13.5 m	12	12	14	15	11	15	14	14	22	27	30	36	28	32	36	30	32	24	18	16	15	14	14	14		
	8.0 m								This level was not instrumented for relative humidity at this time																		
	4.0 m	17	11	12	12	12	12	11	20	25	24	31	38	28	37	37	36	34	26	16	16	14	14	11	10		
	2.0 m	11	10	15	13	10	9	11	21	25	28	31	38	33	38	37	33	34	25	16	13	10	10	8	7		
	1.0 m	9	9	11	12	7	10	11	24	28	29	32	34	29	31	32	31	29	23	13	10	9	8	8	6		
	0.5 m	11	11	13	13	7	10	12	20	24	29	35	39	34	34	36	37	34	26	14	14	13	11	10	8		

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

AUGUST 1967

Exposure		Monthly Means ² of other Elements by Hour																								Monthly Summary			
Site	Code ¹	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	N ³ of obs.	Mean	Max.	
Albrook (Forest site)	WB (4.0 m)	74.0	73.9	73.8	73.6	73.5	73.6	74.3	75.7	76.6	77.3	77.7	77.5	77.6	77.2	77.1	76.8	76.5	75.5	75.0	74.7	74.6	74.5	74.2	74.1	734	69.9	75.4	81.0
	WB (2.0 m)	74.0	73.9	73.8	73.6	73.6	73.6	74.3	75.7	76.8	77.5	77.9	77.7	77.8	77.5	77.3	77.1	76.7	75.6	75.1	74.8	74.6	74.6	74.3	74.1	735	69.8	75.5	81.0
	WB (0.5 m)	74.4	74.2	74.2	74.0	73.9	73.8	74.2	75.6	76.8	77.7	78.4	78.5	78.5	78.0	72.0	77.5	77.2	76.1	75.6	75.2	75.0	74.9	74.5	74.4	721	70.4	75.8	81.5
	BP	.757	.741	.727	.720	.721	.729	.746	.764	.779	.782	.776	.760	.739	.719	.703	.689	.690	.703	.718	.735	.751	.767	.775	.765	744	.595	.740	.845
Albrook (Forest site)	P1	0.00	0.01	0.00	0.00	0.00	0.02	0.05	0.10	0.04	0.00	0.03	0.12	0.02	0.30	0.20	0.35	0.11	0.07	0.04	0.02	0.03	0.00	0.00	0.00	50	0.01	6.16	1.24
	P2	0.00	0.00	0.00	0.00	0.00	0.04	0.03	0.03	0.01	0.00	0.01	0.11	0.01	0.33	0.13	0.37	0.12	0.06	0.09	0.05	0.00	0.00	0.04	0.00	36	0.01	4.87	1.25
	P3	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.06	0.02	0.00	0.02	0.14	0.02	0.29	0.25	0.29	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.00	35	0.01	4.60	1.05
	P4	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.19	0.01	0.06	0.00	0.10	0.01	0.40	0.29	0.25	0.06	0.06	0.06	0.01	0.00	0.00	0.03	0.00	36	0.01	4.77	1.10

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Chiva Chiva (Open site)	WB (4.0 m)	73.9	73.8	73.5	73.5	73.4	73.3	74.4	75.8	76.8	77.3	77.6	77.5	77.5	77.1	76.9	76.6	76.0	75.7	75.3	74.9	74.7	74.6	74.1	73.8	743	68.6	75.3	80.8
	WB (2.0 m)	73.8	73.6	73.4	73.2	73.1	73.0	74.5	76.1	77.1	77.7	78.2	78.1	78.0	77.5	77.2	76.9	76.2	75.8	75.2	74.8	74.6	74.5	73.9	73.7	743	68.2	75.4	81.7
	WB (0.5 m)	73.7	73.6	73.4	73.1	73.1	73.0	74.7	76.7	78.0	78.9	79.5	79.1	78.9	78.6	77.5	76.9	76.2	75.6	75.0	74.7	74.3	74.1	73.9	73.7	737	68.2	75.7	82.8
	BP	.853	.836	.822	.816	.819	.825	.839	.857	.874	.877	.875	.864	.838	.821	.801	.787	.787	.797	.813	.830	.847	.862	.871	.865	743	.690	.861	.945
	PS	0.00	0.00	0.01	0.02	0.00	0.01	0.02	0.46	0.11	0.05	0.00	0.16	0.10	0.34	0.26	0.13	0.21	0.09	0.06	0.02	0.00	0.00	0.01	0.00	54	0.01	8.61	1.60

WB - Wet bulb temperature (°F)
BP - Barometric pressure (in. of Hg minus 29.0)

PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P2 - Precipitation under full canopy (in.)

P3 - Precipitation under drip canopy (in.)
P4 - Precipitation under open canopy (in.)

² Monthly means of precipitation are computed for precipitation days. Precipitation totals are substituted for the mean in the monthly summary.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

AUGUST 1967

Exposure		Monthly Ranges ² of other Elements by Hour																								Monthly Summary*	
Site	Code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Albrook (Forest site)	WB (4.0 m)	3.4	3.5	3.2	3.5	3.8	5.0	4.0	5.2	6.0	5.5	5.2	7.7	8.4	8.5	7.9	6.2	9.3	9.0	7.6	6.9	4.8	3.5	4.0	4.3		
	WB (2.0 m)	3.5	3.5	3.2	3.5	3.8	4.9	4.1	5.2	6.0	5.7	5.6	8.3	9.0	8.8	8.2	8.1	9.2	9.0	7.9	7.0	4.8	3.5	4.1	4.0		
	WB (0.5 m)	3.4	3.8	3.4	3.5	3.7	4.5	4.6	4.7	6.2	5.6	6.6	8.5	8.6	9.2	9.2	8.5	8.9	9.3	8.0	7.5	6.1	4.7	4.5	4.1		
	RP	.165	.175	.175	.175	.195	.195	.195	.175	.195	.160	.165	.170	.160	.160	.155	.150	.150	.145	.135	.130	.135	.135	.145	.145		
	P1	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.23	0.06	0.00	0.03	0.37	0.02	1.23	0.42	0.86	0.25	0.15	0.08	0.04	0.03	0.00	0.00	0.00		
Chiva Chiva (Open site)	P2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.21	0.00	1.24	0.24	0.94	0.18	0.17	0.15	0.00	0.00	0.00	0.00	0.00		
	P3	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.01	0.00	0.00	0.29	0.01	1.04	0.38	1.01	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00		
	P4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.01	1.05	0.56	0.60	0.13	0.12	0.07	0.00	0.00	0.00	0.00	0.00		

* No monthly summary was computed for the ranges.

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Chiva Chiva (Open site)	WB (4.0 m)	4.0	4.2	4.2	4.7	4.2	4.5	4.2	6.2	6.5	5.9	5.8	9.1	8.4	8.8	7.4	7.8	11.3	10.8	8.8	6.7	5.8	4.7	5.1	5.3		
	WB (2.0 m)	4.5	5.5	4.0	5.0	4.8	5.1	4.1	6.5	7.1	7.0	6.2	9.7	9.0	9.6	7.5	8.5	12.0	11.3	9.5	7.5	6.5	5.0	5.5	5.8		
	WB (0.5 m)	4.7	5.0	4.5	5.0	4.8	4.8	3.9	7.5	8.1	6.4	7.5	11.0	10.4	10.7	8.2	9.0	12.8	10.7	8.2	7.3	5.5	4.7	5.0	5.6		
	RP	.155	.175	.180	.175	.190	.190	.170	.180	.175	.170	.165	.160	.160	.175	.145	.160	.160	.135	.150	.125	.135	.135	.135	.140		
	PS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.24	0.00	0.00	0.44	0.27	0.53	1.59	0.51	0.71	0.24	0.08	0.02	0.00	0.00	0.00	0.00		

W8 - Wet bulb temperature (°F)
 RP - Barometric pressure (in. of Hg minus 29.0)

PS - Precipitation at 4.0 m. in open area (in.)
 P1 - Precipitation at 46.0 m. above canopy (in.)
 P2 - Precipitation under full canopy (in.)

P3 - Precipitation under drip canopy (in.)
 P4 - Precipitation under open canopy (in.)

² Monthly ranges of precipitation are computed for precipitation days.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

AUGUST 1967

Exposure		Monthly Means of Wind Speed by Hour (miles/hr.)																								Monthly Summary				
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Mean	Max.		
Albrook (Forest site)	46.0 m	5	6	5	5	6	5	5	5	5	7	8	8	8	8	7	8	7	7	7	6	6	6	5	6	6	672	0	6	21
	28.5 m	This level was not instrumented for wind speed at this time																												
	26.5 m	2	2	2	2	2	2	2	2	2	2	3	4	4	4	4	3	3	3	3	2	3	2	2	2	464	0	3	14	
	13.5 m	This level was not instrumented for wind speed at this time																												
	8.0 m	This level was not instrumented for wind speed at this time																												
	4.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	699	0	0	4
	2.0 m	This level was not instrumented for wind speed at this time																												
1.0 m	This level was not instrumented for wind speed at this time																													
0.5 m	This level was not instrumented for wind speed at this time																													

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[illegible]

AUGUST 1967

* No monthly summary was computed for the ranges.

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Chilva Chilva (Open site)

ALBROOK (Forest site) AUGUST 1967

Relative Frequencies* of Wind Directions by Hour at 46.0 m. (%)																									
Hz.	Dir	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	N	3.2		6.4	3.2	3.2	3.2	9.7		6.4	6.4	3.2	12.9	6.6	9.7	9.7	3.2				3.2	9.7	6.4		3.2
	NNE				6.4	3.2	3.2	6.4	3.2	6.4	3.2		3.2	3.3				3.2			6.4		3.2		
	NE	3.2	3.2		3.2	3.2	6.4	3.2	3.2	3.2	6.4				3.2			3.2	9.7	3.2					
	ENE			3.2					3.2		3.2			3.3			3.2	3.2							3.2
	E							3.2		3.2	3.2	3.2	3.2	6.6			3.2	3.2							
	ESE								3.2		3.2		3.2	3.3				3.2	3.2						
	SE					3.2			3.2	9.7	3.2	3.2					3.2		6.4	3.2					
	SSE									3.2	3.2	6.4	9.7	3.3	3.2	6.4									
	S										6.4	9.7	16.1	13.3	12.9	9.7	3.2				3.2				
	SSW				3.2						3.2	9.7	3.2	6.6	3.2	6.4		3.2				3.2		3.2	
	SW	3.2		9.7			3.2		9.7	3.2	16.1	9.7	12.9	13.3	12.9	6.4	19.4	3.2	9.7	6.4	9.7	3.2	3.2	3.2	3.2
	WSW	9.7	3.2	3.2	3.2	9.7	3.2	3.2	12.9	12.9		16.1	9.7	10.0	16.1	9.7	9.7	6.4	19.4	9.7	3.2	3.2	9.7	9.7	22.6
	W	22.6	25.8	22.6	38.7	22.6	29.0	9.7	22.6	22.6	22.6	19.4	6.4	10.0	12.9	25.8	29.0	22.6	29.0	25.8	25.8	22.6	22.6	22.6	25.8
	WNW	32.2	41.9	32.2	19.4	22.6	16.1	25.8	9.7	9.7	6.4	3.2	6.4	16.6	6.4	9.7	12.9	16.1	6.4	25.8	22.6	25.8	12.9	29.0	12.9
	NW	19.4	22.6	16.1	19.4	19.4	19.4	22.6	22.6	16.1	12.9	6.4	9.7		3.2	12.9	3.2	12.9	6.4	16.1	16.1	22.6	19.4	9.7	16.1
	NNW		3.2	3.2	3.2	6.4	9.7	9.7	6.4	3.2		6.4			9.7		6.4	12.9	6.4	3.2		9.7	16.1	3.2	
	CALM	6.4		3.2		6.4	6.4	6.4				3.2	3.2	3.3	6.4	3.2	3.2	6.4	3.2	6.4	9.7	9.7	12.9	9.7	9.7

* Note: Due to rounding, percentage totals do not equal 100%.

1967-08-01 to 1967-08-31

ALBROOK (Forest site) AUGUST 1967

		Relative Frequencies* of Wind Directions by Hour at 26.5 m. (%)																							
Dir.	Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N		6.4	3.2	9.7	9.7	3.2	9.7	6.4	12.9	3.2	9.7	9.7	9.7		6.4	6.4	9.7	12.9	9.7	19.4	3.2	6.4	6.4	9.7	3.2
NNE		3.2	3.2				3.2		3.2		3.2		3.2	3.3	12.9	3.2			3.2	3.2	6.4	3.2	9.7	3.2	
NE		3.2	6.4		6.4	3.2	6.4	3.2		6.4							3.2	3.2	3.2		6.4	3.2	3.2		3.2
ENE						3.2		3.2			3.2		3.2										3.2		
E									3.2	6.4	9.7	3.2	3.2	3.3	3.2					3.2				3.2	
ESE					3.2			3.2		3.2	3.2					3.2	6.4	3.2							
SE				6.4		3.2					6.4	3.2	3.2	6.6	3.2		3.2		3.2						
SSE												3.2	3.2	3.3	6.4	9.7		3.2	3.2						
S							3.2		3.2	3.2	6.4	16.1	25.8	23.3	9.7	3.2		5.4			3.2				
SSW						3.2	3.2		3.2		6.4			3.3	6.4										
SW						3.2	3.2	3.2	6.4	6.4		6.4	6.4	6.6	3.2	3.2		3.2	3.2					3.2	
WSW								3.2	3.2			6.4		3.3				3.2							3.2
W		12.9	6.4	6.4		9.7	3.2	6.4	9.7	9.7	3.2	6.4	3.2	3.3	9.7	22.6	12.9	12.9	12.9	3.2	6.4	6.4	9.7		6.4
WNW		3.2	19.4	6.4	16.1	9.7	6.4	9.7	3.2	6.4	6.4	9.7	9.7		3.2	9.7	19.4	6.4	16.1	9.7	12.9	6.4		3.2	19.4
NW		25.8	32.2	29.0	25.8	12.9	19.4	19.4	25.8	25.8	19.4	22.6	16.1	23.3	12.9	19.4	25.8	19.4	12.9	35.5	25.8	35.5	16.1	29.0	22.6
NNW		25.8	12.9	19.4	19.4	32.2	19.4	25.8	9.7	9.7	12.9	6.4	6.4	10.0	16.1	16.1	12.9	16.1	19.4	16.1	22.6	25.8	32.2	35.5	22.6
CALM		19.4	16.1	22.6	19.4	16.1	22.6	16.1	16.1	19.4	9.7	6.4	6.4	10.0	6.4	3.2	6.4	9.7	12.9	9.7	12.9	12.9	16.1	12.9	19.4

* Note: Due to rounding, percentage totals do not equal 100%.

1967-1968, B. A. 0004

ALBROCK (Forest site) AUGUST 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.

(%)

Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	'6	17	18	19	20	21	22	23	24
Dir.																								
N											3.7	6.6	3.3		3.3	3.3								
NNE																								
NE															3.3	6.6								
ENE																3.3					3.3			
E															3.3									
ESE													3.3											
SE														3.3										
SSE																								
S													3.3											
SSW																								
SW																								
WSW											3.7			3.3				3.3						
W										7.3			3.3		3.3			3.3			3.3			
WNW														3.3				3.3						
NW								3.8			3.7			6.6	3.3		3.3			3.3				3.3
NNW													6.6					3.3	3.3			3.3		
CALM	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	95.8	92.3	88.9	93.0	79.7	83.0	83.0	56.4	96.3	89.7	93.0	96.3	96.3	96.3	96.3	96.3

• Note: Due to rounding, percentage totals do not equal 100%.

Relative Frequencies* of Wind Directions by Hour at 26.5 m.

INTERPOLAR S. A. 41091

INSTRUMENTA, D. A. 4896

CHIVA CHIVA (Open site) AUGUST 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.																									
(%)																									
Dir.	Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N		12.9	10.0	6.4	19.4	6.4	6.4	6.4	9.7	6.4	12.9		12.9	6.4	3.2	9.7	6.4	19.4	9.7	22.6	12.9	16.1	29.0	6.4	6.4
NNE		3.2	3.3	6.4	6.4	3.2	6.4	3.2			3.2			3.2	3.2	3.2	3.2	6.4	3.2	3.2		3.2		9.7	3.2
NE		9.7	6.6		6.4	9.7	12.9	3.2			3.2			3.2					3.2	3.2	9.7	6.4	6.4		3.2
ENE				3.2		3.2		3.2	3.2		3.2	3.2		3.2	3.2	3.2	3.2	3.2			3.2		6.4	3.2	3.2
E			3.3	6.4	3.2							3.2		3.2			6.4		3.2		3.2		3.2		
ESE		3.2				3.2				3.2		3.2						6.4							
SE										3.2	3.2	6.4	3.2	6.4					3.2						
SSR				3.2						3.2	3.2	3.2	3.2		6.4	3.2						3.2			
S			3.2			3.2					6.4	3.2	12.9	12.9	6.4	16.1	9.7	3.2			6.4	3.2			6.4
SSW						3.2	6.4			3.2		3.2	6.4									3.2			
SW			3.3				3.2		9.7	12.9	3.2	6.4	12.9	12.9	22.6	9.7	3.2	3.2				6.4	6.4	6.4	
WSW			3.2	3.2		3.2			3.2	9.7	3.2	6.4	3.2		9.7	9.7	16.1	3.2	6.4	3.2	6.4	3.2		3.2	3.2
W		9.7	3.3	6.4	3.2			3.2	9.7	16.1	9.7	6.4	16.1	9.7	3.2	6.4	6.4	9.7	12.9	6.4	12.9	3.2	6.4	12.9	6.4
WNW		9.7	13.3		6.4	12.9		12.9	29.0	9.7	12.9	16.1	9.7	6.4	9.7	6.4	16.1	6.4	22.6	16.1	6.4	3.2	12.9	9.7	3.2
NW		16.1	6.6	19.4	9.7	9.7	9.7	22.6	12.9	3.2	12.9	19.4	9.7	12.9	19.4	19.4	16.1	35.5	16.1	35.5	22.6	35.5	16.1	12.9	19.4
NNW		22.6	10.0	12.9	6.4	19.4	16.1	12.9	16.1	25.8	22.6	19.4	9.7	19.4	12.9	12.9	12.9	3.2	19.4	9.7	12.9	12.9	12.9	12.9	16.1
CALM		12.9	33.2	22.6	38.7	22.6	38.7	32.2	6.4	3.2														22.6	29.0

* Note: Due to rounding, percentage totals do not equal 100%.

SUMMARY OF NON HOURLY DATA

AUGUST 1967

Summary of Elements with Non-hourly Frequencies of Observation						
Site	Element, Units and Exposure	Description	Number of Obs.	Minimum Value	Mean or Total Value	Maximum Value
Albrook (Forest site)	WBGT Index ¹ (at 1.0 meters)	Index value	434	70.2	77.4	82.6
		Dry bulb temp.	434	69.5	78.3	87.1
		Wet bulb temp.	434	69.5	76.8	82.0
		Black bulb temp.	434	72.0	78.8	87.5
	Evaporation ³ (in. at 4 levels)	Piche (46.0 m)	31	0.079	7.353*	0.451
		Piche (26.5 m)	31	0.055	5.201*	0.317
		Piche (13.5 m)	29	0.012	2.156*	0.179
		Piche (0.5 m)	25	0.006	0.889*	0.073
	Precipitation from Raingauge Network ² (in. at 1.0 meters)	Gauge # 1	20	0.01	6.31*	2.30
		Gauge # 2	20	0.02	6.58*	2.75
		Gauge # 3	20	0.02	7.13*	2.36
		Gauge # 4	20	0.01	6.88*	2.33
		Gauge # 5	20	0.01	5.02*	1.61
		Gauge # 6	20	0.02	5.64*	1.45
		Gauge # 7	21	0.02	5.43*	1.93
		Gauge # 8	20	0.01	5.48*	1.81
	Stem Flow ² (in. at 2.0 meters)	Small tree	20	0.01	5.61*	1.13
		Medium tree	18	0.01	6.24*	3.04
		Large tree	9	0.01	40.57*	34.64
Chiva Chiva (Open site)	WBGT Index ¹ (at 1.0 meters)	Index value	434	69.1	80.1	90.7
		Dry bulb temp.	434	69.2	81.0	94.1
		Wet bulb temp.	434	69.2	77.2	83.0
		Black bulb temp.	434	68.5	89.5	120.2
	Evaporation ³ (in. at 0.5 meters)	Piche	31	0.012	4.372*	0.305
		Pan	28	0.003	4.13*	0.939
	Minimum Grass temp ³ (°F at grass tips)	None	28	68.2	70.9	74.0

1 - Hourly observations between 0600 and 1900 hours inclusive

2 - Six hourly observations

3 - Daily observations

*Total Values

UNCLASSIFIED

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13. ABSTRACT This report contains detailed microclimatic data for August 1967 from specific sites in the Panama Canal Zone and vicinity. The data are presented in tabular form, summarized for hourly and/or daily observations from surface to 46-meter levels. Elements listed are: temperature, pressure, precipitation, wind speed and direction, relative humidity, and evaporation.			

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
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